

Routes, timing, and stopovers of migrating sub-adult Florida Bald Eagles

Rutas, sincronización, y paradas de las Águilas de Cabeza Blanca Juveniles en Florida



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Introduction Introducción

Band recoveries indicate that Florida eagles migrate as far north as Prince Edward Island, Canada in summer and return to Florida in winter (Broyer 1947, Wood and Collopy 1994, Millsap et al. 2004). Few studies have examined these long-term movements in detail, however, because of technological problems in tracking long-distance migration and the cost of equipment and person-hours to follow them. We used satellite telemetry data collected by Millsap et al (2004) to describe migratory pathways, stopover sites and timing of migratory Florida sub-adult Bald Eagles in eastern North America.

Objectives Objetivos

1. Determine migration timing
2. Describe migratory routes
3. Locate migratory stopover sites

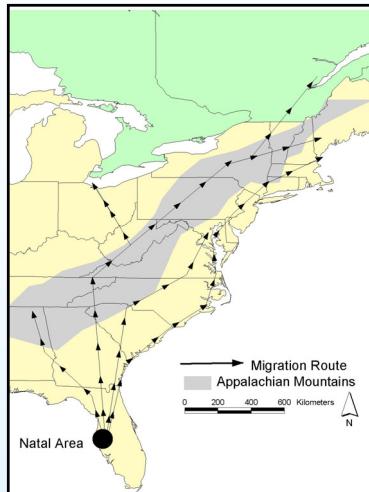


Figure 1. Migration routes followed by Florida sub-adult Bald Eagles ($n = 54$) ages 1-5, 1997-2004. Return routes south similar. Las rutas de migración seguidas por las águilas de Cabeza Blanca juveniles de Florida ($n = 54$) edades 1-5, 1997-2004. Las rutas de vuelta al sur fueron similares.

Methods Métodos

Satellite locations were collected from Florida sub-adult Bald Eagles ($n = 54$) fitted with 5-yr 95g PTTs as nestlings (Millsap et al 2004). Data spans years 1997-2004.



Migration timing

- Compared first-year migration length between spring and fall migration (paired t-test, $n = 40$).

Migration Routes

- Used satellite data accurate ≥ 1 km (Location class = 0-3, A, B) to define routes taken by first-year migrating eagles
- Distance traveled = sum of linear distance between winter and summer areas.
- Compared distance between routes, sexes, and calendar year using 3-way ANOVA (SAS Institute Inc 2003).

Stopovers

- Identified stopover sites with satellite data accurate ≤ 1 km (Location class ≥ 0 , X>3, Y>2, NOPC ≥ 2 , pass duration >200 ; from Millsap et al 2004)
- Sites used for localized movements 6 to 31 days during the migration period.

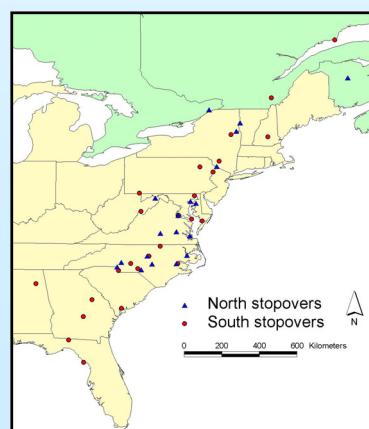


Figure 2. Stopover sites used by Florida sub-adult Bald Eagles ($n = 25$) ages 1-4 during northbound and southbound migration, 1997-2004. Áreas de parada usadas por las águilas de Cabeza Blanca juveniles de la Florida ($n = 25$) edades 1-4 durante la migración del norte y del sur, 1997-2004.

Results Resultados

Migration timing

- Spring migration: March - July (mean = May 2, $n = 71$), Fall migration: July – December (mean = September 19, $n = 104$)
- Migration south was longer than north (paired t-test, mean difference = 11 days, SE = 5, df = 38, $t = 2.2$, $P = 0.03$)

Migration Routes

- Equal use of Coastal Plain ($n = 24$) and Appalachian Mountains ($n = 26$, Fig. 1).
- Coastal migrants traveled less (mean = 1,397 km) than mountain migrants (mean = 2,112 km; $F_{1,31} = 9.11$, $P = 0.005$).
- The farthest summering site was 4,146 km from Florida in coastal Labrador, Canada (51°N)
- Summer sites ranged from Lake Marion, South Carolina (33°N) to NW Labrador (55°N)

Stopovers

- Stopovers were visited 1 to 3 times during migration, staying 6 to 31 days (mean = 14.8 days; 95% CI: 12.8 – 16.8; $n = 54$; Fig. 2)

Discussion Discusión

- This study was the first to describe Bald Eagle migratory routes along the Appalachian Mountains and Mississippi Valley. Earlier studies indicated that eagles used coastal routes predominantly (Broyer 1947, Wood and Collopy 1994), but we found equal use of coastal and mountain migratory routes.
- We recorded migration distances $>1,000$ km longer than those reported in previous studies for adults and sub-adults (range: 1,450 to 3,032 km) from summering and nesting grounds to wintering grounds (Grubb et al. 1994, McClelland et al. 1994, Wood and Collopy 1994).
- Migration route used may explain some difference in distance traveled, since we found coastal migrants traveled less distance overall than mountain migrants. Mountain migrants may be able to travel farther by soaring or gliding on more abundant updrafts than are found in the Coastal Plain (Heintzelman 1975, Hunt et al. 1992).
- Our estimated time spent at stopovers was consistent with previous studies of hatch-year sub-adults (mean = 14.5, range 1-25 days, Restani 2000, Laing et al. 2005).

Acknowledgements Reconocimiento

Research was funded by the Florida Non-game Wildlife Trust Fund, U.S. Fish and Wildlife Service (Section 6 program), USGS Patuxent Wildlife Research Center, The University of Georgia, Georgia Ornithological Society, and the Sprouse family.

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